NOTES ON THE WOOD ANATOMY OF IDIOSPERMUM AUSTRALIENSE (IDIOSPERMACEAE)

by

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ABSTRACT

Foreman, D. B. Notes on the wood anatomy of *Idiospermum australiense* (Idiospermaceae). *Muelleria* 6(5): 329-333 (1987). — Results of a study of the wood of *Idiospermum australiense* using scanning electron microscopy confirm that in mature secondary xylem exclusively simple perforation plates are present whereas in the secondary xylem of seedlings simple perforation plates as well as a few scalariform perforation plates with up to about five bars are found. Earlier reports that had indicated multiple scalariform or scalariform perforation plates were features of the mature secondary xylem are clearly erroneous. Idiospermaceae appears to occupy an isolated position in the Laurales, allied to Calycanthaceae.

INTRODUCTION

Following the rediscovery in 1971 of *Idiospermum australiense* (Diels) S.T. Blake (*Calycanthus australiensis* Diels) in the Daintree region of north Queensland, after it had been implicated in the poisoning of a number of cattle at Noah Creek, there has been keen interest in the plant. It appeared to occupy an interesting position amongst the putatively primitive angiosperms because of its distinctive wood anatomy and peculiar embryo structure.

This paper is an expansion of a poster presented at *The Ecology of Australia's Wet Tropics 1986 Conference* held in Brisbane, Queensland, from 25-27 August 1986.

METHOD AND MATERIALS

A small piece of wood taken from the stem of a mature tree grown in its natural habitat was obtained from B.P.M. Hyland, QRS, Atherton, north Queensland.

Seedlings were grown in the Department of Botany glasshouse at the University of New England from seed collected by B.J. Wallace in 1979 from the Daintree region in north Queensland. Vouchers for the specimens are lodged at QRS and NE respectively.

The wood was trimmed with a razor blade to a cube about 0.5 cm square, air dried, then sputter coated with a thin layer of gold and examined with a JEOL JSM-35 SEM.

OBSERVATIONS

Secondary xylem from the wood sample obtained from the stem of the tree grown in its natural habitat was found to have vessel elements with exclusively simple perforation plates in moderately oblique to almost transverse end walls (Fig. 1a). Most of the vessel elements seen in this sample were about 200 μm in diameter and from 300-500 μm in length. Intervessel pitting is alternate, crowded and with the pit apertures being narrow-elliptic (Fig. 1b). The pitting between the vessel elements and the ray and axial parenchyma showed considerable variation in form and orientation. Most of the pits are elliptic but some are circular or linear. The pits may be oriented obliquely, vertically or horizontally (Fig. 1c).

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The vessel elements in the secondary xylem of the seedling root were about 100 μm in diameter and about 350-400 μm in length (Fig. 1d). They appeared to lack the linear pits present in the secondary xylem of the tree stem. Exclusively simple perforation plates were found in the samples examined.

The diameter of the vessel elements from the secondary xylem of the seedling stem also showed a decrease in diameter, many averaging between 50-75 μm. These vessel elements, like those from the tree stem, had occasional linear pits which were at times arranged in a more or less vertical pattern (Fig. 1e). In addition to simple perforation plates identical to those found in the secondary xylem of the tree stem and seedling root a few scalariform perforation plates with about 5 bars were found in the wood sample taken from the seedling stem. A few reticulate connections were observed between some of the bars (Fig. 1e).

DISCUSSION

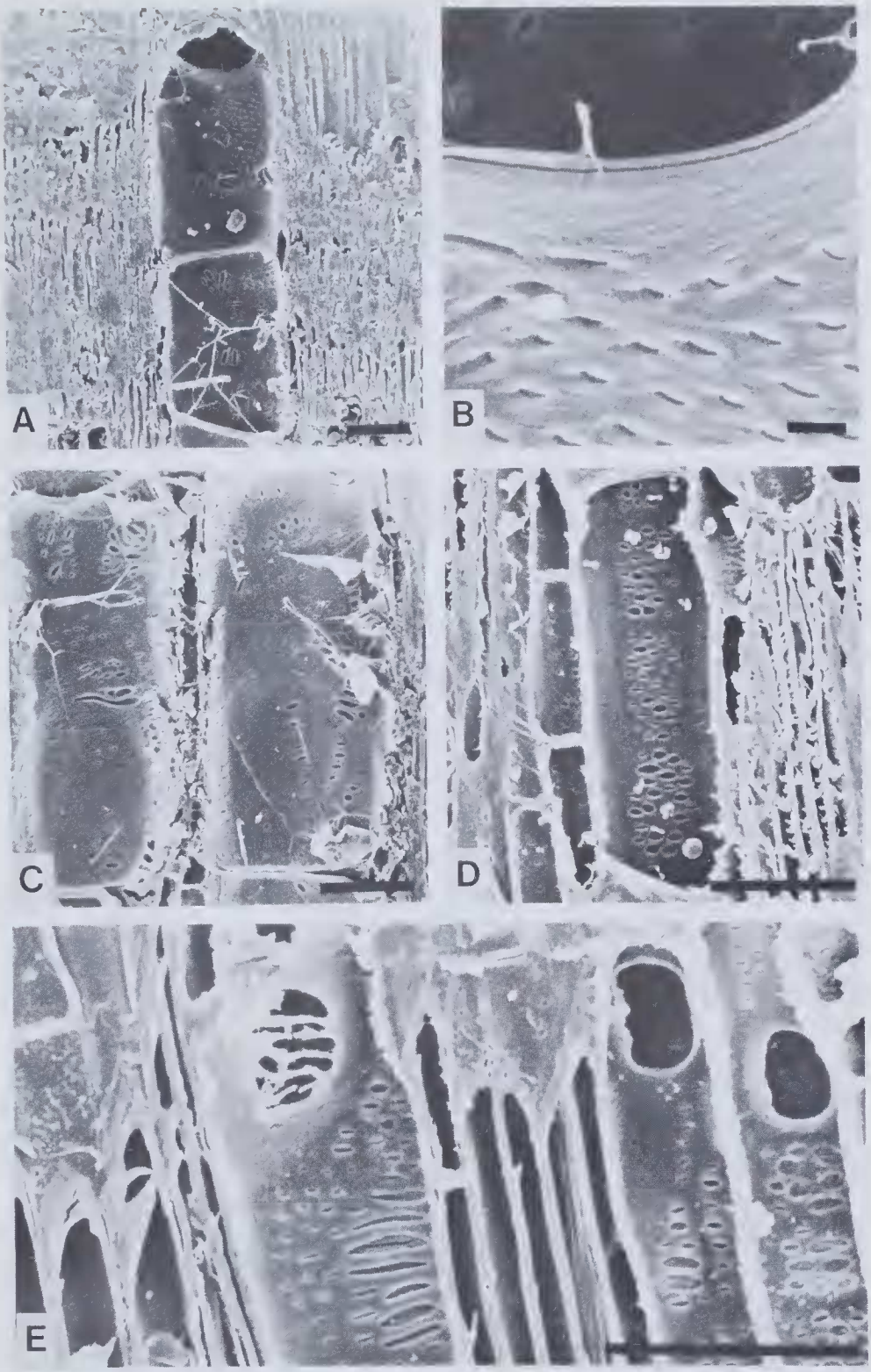
Until the rediscovery of *Idiospermum australiensis* in 1971 its fruits were unknown. According to Blake (1972) the peculiar embryo with its 3-4 quite distinct, massive, subsessile cotyledons were unlike any other family previously described. From notes supplied by Mr W.J. Smith (Blake, 1972) it was also apparent that the wood of *I. australiensis* was distinctive and reportedly included the feature "vessel perforations multiple, scalariform." Primarily on the basis of the peculiar embryo and the distinctive wood found in *I. australiensis* Blake (1972) not only described a new genus *Idiospermum* but also placed it in a new family the *Idiospermaceae.*

If the report of multiple scalariform perforation plates in the secondary xylem of *Idiospermum* was accurate it would have been an unusual feature indeed amongst the extant putatively primitive angiosperms. Apart from families such as Winteraceae, which lack vessels and which have tracheids with scalariform pits in their oblique end walls, most other putatively primitive angiosperms have vessel elements with scalariform perforation plates in very oblique to oblique end walls. A few taxa, such as *Palmeria* F. Muell. (Monimiaceae), have simple perforation plates in oblique to almost transverse end walls.

Lamont (1974) reported briefly on *Idiospermum,* calling it "a living primitive angiosperm." According to his report, *Idiospermum* possessed 13 primitive characters including secondary xylem with vessels having scalariform end-plates and side walls. This work was based partly on the earlier account by Blake (1972).

Following a detailed study, Wilson (1976, 1979) described and discussed various aspects of the floral and vegetative anatomy of *Idiospermum,* comparing many of the features with members of the Calycanthaceae. As a result of these studies Wilson (1979) was unable to confirm the presence of multiple scalariform perforation plates which had previously been reported by Smith in Blake (1972) or scalariform end plates and side walls as reported by Lamont (1974). Wilson (1979) reported finding exclusively simple perforation plates in moderately oblique to almost transverse end walls in the wood sample he examined. In addition, Wilson (1979) also reported finding conspicuous pitting between vessel elements and ray and axial parenchyma which varied greatly in form and size. The pits ranged in shape from circular to strongly elliptical or linear with typical linear pits being about three times longer than wide (average 22 μm in length). The elliptic and linear pits were found to be horizontally, obliquely, or vertically oriented. These findings are in

Fig. 1. *Idiospermum australiense.* a—L.S. of vessel elements from tree grown in natural habitat showing simple perforation plates in moderately oblique to almost transverse end walls. Bar = 100 μm. b—Portion of vessel element from tree grown in natural habitat showing intervessel pitting. Bar = 10 μm. c—L.S. of vessel elements from tree grown in natural habitat showing the variety of pitting between vessel elements and the ray and axial parenchyma. Bar = 100 μm. d—L.S. of vessel elements from seedling root. Bar = 100 μm. e—L.S. of vessel elements from seedling stem showing a scalariform perforation plate, several simple perforation plates and vertically arranged linear pits. Bar = 100 μm.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agreement with those of the present study for the wood obtained from a tree grown in its natural habitat. The close agreement between the findings of Wilson (1979) and some aspects of the present observations is not surprising since wood samples for both studies were obtained from the same source.

Unfortunately the misleading report (Blake, 1972) of exclusively scalariform perforation plates in *Idiospermum* has been perpetuated in Cronquist (1981) for it would appear that the work of Wilson (1979) was not published in time for it to have been considered by Cronquist.

From the scanning electron-micrographs it may be difficult to imagine how the initial misinterpretation given in Blake (1972) could have been made. However, when a radial longitudinal section of secondary xylem (Wilson 1979, Fig. 19) is examined under a light microscope it is much easier to understand how the confusion could have risen. The variety of pitting between the vessel elements and the ray and axial parenchyma is clearly seen in a radial longitudinal section of the wood of *Idiospermum*. In particular the linear or strongly elliptical pits when arranged in a vertical fashion could give the impression of a scalariform perforation plate (Fig. 5). When a number of pits occur in close proximity to each other they could possibly be mistaken for scalariform perforation plates in the side walls of the vessel elements or even for multiple scalariform perforation plates in the end walls of vessel elements.

The discovery of scalariform perforation plates in young stems of *Idiospermum* in a taxon which otherwise has simple perforation plates is not a unique occurrence amongst the putatively primitive angiosperms. The Himantandraceae, a family placed by Cronquist (1981) in the order Magnoliales but which also has some affinities with the Laurales, has vessel elements with simple perforation plates although in young stems some of the perforation plates may be scalariform. In the Monimiaceae (*s.l.*), a key family to the understanding of relationships in the Laurales, some taxa such as *Bracteanthus glycycarpus* Ducke (Araujo & Filho, 1973b) and *Siparuna bifida* (Poeppig & Endl.) A.DC (Araujo & Filho, 1973a) also have a combination of simple perforation plates and scalariform perforation plates with up to seven bars.

Dahlgren (1980), Takhtajan (1980) and Thorne (1981) all include *Idiospermum* in the Calycanthaceae with the latter two authors recognising the taxon at sub-family level. The work of Wilson (1979) supports the relationship between the Idiospermaceae and the Calycanthaceae and also the recognition by Blake (1972) and Cronquist (1981) of the Idiospermaceae at family level.

Cronquist (1981) considers the Idiospermaceae to be part of his order Laurales where it occupies a somewhat isolated position allied to the Calycanthaceae. While there is some disagreement amongst the authors as to the status of the Idiospermaceae there appears to be general agreement about its placement amongst the Lauralean families.

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